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Note: See correction of last month's cover on page 18 of this issue.—The Editor

Electronic Configuration of the Mohawk AOM

THIS ARTICLE INITIATES *a new policy under this title of providing timely information to aviators in the field on recent briefings and major actions which take place in the Pentagon.*

In a recent briefing Captain George Rizor of OCSigO, R&D, presented the following information on the electronic equipment which will be installed in the Mohawk AOM, the improved observation airplane developed by Grumman.

The production models of the Mohawk will be quite different from the prototype scheduled to begin engineering tests in early 1959. The "Y" models will contain standard navigation and communication systems, giving them a capability for visual observation, day/night photography, and other miscellaneous Army Aviation missions. All production aircraft will contain additional communication equipment, self-contained navigation and integrated flight instrumentation systems. The "A" model will also contain Infrared (IR) equipment capable of strip mapping terrain and pinpointing concealed objects both day and night. The "B" model will contain Side Looking Airborne Radar (SLAR) equipment capable of strip mapping the terrain and pinpointing objects on the surface under any visibility conditions.

Many items of electronic equipment are required to fulfill the various functional requirements of these complex airborne surveillance systems. The functions required and the best available equipment (compatible with proposed production aircraft delivery schedules) chosen for use in the "A" and "B" model Mohawk aircraft are as follows:

FUNCTION	ELECTRONICS EQUIPMENT
COMMUNICATION	
UHF	Radio Set, AN/ARC-51
FM	Radio Set, AN/ARC-44 (with AN/ARR-46 in "B" model)
HF	High Frequency Radio Set, AN/ARC-39
Interphone	Interphone Control, AIC-12
NAVIGATION	
Heading Reference	Gyro Magnetic Compass System (Lear MA-1) furnished as a component of the self-contained navigation system
ADF	Direction Finder Set, AN/ARN-59
TACAN	Radio Set, AN/ARN-21
Marker Beacon	Marker Beacon Receiver with 3-light adapter, R-737/ARN
FM Homer	Antenna Group, AN/ARA ( ), (modification of the AN/ARA-31)
Self-contained Navigation System	Automatic (Doppler) Navigation and Flight Control System, Ryan Model 120A

Integrated Flight System	Integrated instrument furnished as a component of the self-contained navigation system
Absolute Altimeter	Radar Set (Radar Altimeter), AN/APN-22
Autopilot	Universal Autopilot, AN/ASN ( ), (under development at Sperry Gyroscope)
IDENTIFICATION	
IFF	Transponder Set, AN/APX-44
Ground Tracking Beacon	Transponder Set, AN/APW- ( ), (the airborne portion of the AN/UPW-1 under development at Ford Instrument Company)
SURVEILLANCE SYSTEMS	
Photo	Aerial Camera System, KA-30 (alternate capability only, in "B" model)
Camera Control	Joint Army-Navy Camera Control System (JANCCS)
IR ("A" model only)	Infrared Surveillance System, AN/UAS-4 (XE-1)
SLAR ("B" model only)	Radar Reconnaissance System, AN/APS-94

The UHF communication and TACAN navigation radio sets have been included in the "A" and "B" models of the Mohawk for use in the forthcoming common Traffic Control and Navigation System within the continental United States. In addition these items will be required for operations in conjunction with the Air Force and Navy in many future tactical situations. Provision will be made to allow removal of both these items when they are not required. The UHF, AN/ARC-51, presently under development at Collins Radio Company will furnish the Mohawk with 18 preset channels (1750 available), plus a single guard channel in a small 35 lb., 6/10 cu. ft. package. The AN/ARN-21 is the present Navy standard TACAN.

The FM Radio Set, AN/ARC-44, is the standard tactical radio in most Army aircraft today and will be used as such in the Mohawk. The "B" model will contain an AN/ARR-46 Radio Receiving Set for use as a single channel monitoring receiver.

The High Frequency Radio Set, AN/ARC-39, is required for long range and non-line-of-sight communications. This 12 preset channel set weighs 40 pounds and is capable of more than 10 watts output. The interphone system through which all the communications and navigation equipment operates is a small 2¼-pound system, and is compatible with the headset and microphone in the new Army Aviator Protective Helmet (Navy Type APH-5 modified).

The standard AN/ARN-59 ADF is required for operation in the present Army Aviation Air Traffic Tactical Operations System. The Marker Beacon Receiver, R-737/ARN, is not only required for tactical Army use but in the common system of air traffic control as well. The FM Homer Antenna Group, AN/ARA-( ), is required as an emergency navigation assist. For its additional 4 pounds, this unit will give the Mohawk pilot the capability of homing on any FM ground radio within the frequency range of the AN/ARC-44.

The Self-Contained Automatic Doppler Navigation and Flight Control System is required not only by the pilot for tactical mission navigation, but also by the Infrared and Radar Surveillance Systems. This information

furnished by the Doppler navigator is used by these surveillance units much as shutter speed information is used by a photographer. The absolute altimeter information is used by these devices in the same manner range finder information is used by a photographer. This system furnishes the pilot more information than any system presently in use in Army aircraft. With no more panel space available, some integration of instrumentation is a necessity. The self-contained navigation system allows the pilot to discard his E6B computer and maps by furnishing him information on the instruments indicated below.

Integrated Instrument
- **Aircraft Attitude**
- **Aircraft Heading**
- **Aircraft Rate of Turn**
- **Aircraft Slip**

Bearing and Distance Indicator
- **Present Ground Track**
- **Ground Track to Destination**
- **Course Error**
- **Distance to Destination**

Ground Speed / Drift Angle Indicator
- **Groundspeed**
- **Drift Angle**

Navigational Computer-Indicator
- **Present Latitude and Longitude**
- **Destination Latitude and Longitude**
- **Magnetic Variation**
- **Wind Direction and Speed**

Dead Reckoning Position Indicator
- **Pictorial Display of:**
  - **Present Position**
  - **Relative Aircraft Heading**
  - **Destination**
  - **Desired Course**

All this information furnished the pilot directly on the Mohawk instrument panel and consoles eliminates the need for a copilot. However, since a trained surveillance equipment operator/observer is required for the IR and SLAR systems, the aircraft must still be two-place.

The Universal Autopilot, AN/ASN - ( ), is required in both the "A" and "B" models to stabilize these aircraft during operation of the IR and SLAR systems. This autopilot is presently under development. Weighing only 41 pounds, it will stabilize the aircraft's pitch, roll, and yaw axes in addition to its altitude.

The transponder, AN/APX-44 IFF, set in these aircraft will be a welcome sight to all Army Aviators. The transponder set AN/APW - ( ), Ground Tracking Beacon, will be used to enhance the radar scope return of the Mohawk aircraft on various line-of-sight tactical missions when the aircraft is being flown with the guidance of a ground based radar set.

The Aerial Camera System, KA-30, will furnish a day and night photographic capability with image motion compensation on a 4½" x 4½" format using either 3", 6" or 12" lenses.

Technical information and operational data on the IR and SLAR systems under development are classified and cannot be discussed in this article.

The extended capability of the Mohawk aircraft is paid for in added weight. However, this weight is within the design limits of the aircraft and its performance is not expected to be appreciably lowered in the "A" and "B" models.

These aircraft are certainly a radical departure from present Army observation aircraft. Those working in the combat surveillance field are confident that the Mohawk will prove of great value to the Army in its search for a greater target acquisition capability.

Helicopter-Borne Operations

Brigadier General Carl I. Hutton, *USA*

OBSERVATION OF SOME recent helicopter-borne exercises pointed out the necessity for emphasis upon some basic principles in that type of operation. There is nothing new about the principles. They make sound tactical sense and when they are ignored they not only endanger the success of the operation, but they also create an impression of excessive vulnerability in observers' minds. Despite explanations that certain practices are followed for reasons of peacetime safety, a mental image of a profitable target is likely to remain.

The helicopter-borne operation should preferably be made onto an UNOCCUPIED OBJECTIVE. Helicopters are especially vulnerable to enemy fire during the short period when they are on the ground discharging troops. On today's thinly occupied battlefield, it should not be difficult to find objectives for the helicopter-borne elements which put the forces behind or upon the flanks of the enemy force. If the objective is occupied, supporting fires must be lifted prior to the landing, with the likelihood that the enemy will have time to come out of shelters and man his weapons during the most vulnerable period. When the landing area is on the flank or behind the objective, the supporting fires can be maintained during the landing phase.

Some particular condition may favor making an exception to this principle. Glider landings are supposed to have been made upon Fort Ebn Emael* in safety because the fort was not designed to resist an attack from the air. If the objective for the helicopter-borne operation should be similarly vulnerable, the action may well be planned to land directly upon it.

The helicopter-borne force should be delivered with SURPRISE. The achievement of surprise is possible either in the selection of the point of action or in timing, or both. The entire width and depth of the battlefield are exposed to the helicopter-borne operation. Static defense by weapons in position will require that the enemy try to defend everywhere, resulting in dispersal of his weapons. A 100 percent defense everywhere will result in a 99 percent waste of effort, since it will be effective only at the exact point of attack.

Areas of difficult terrain, which are difficult obstacles for troops on the ground and their vehicles, favor achievement of surprise in space. Smoke may be

*Near Liege, Belgium, 1940.

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used in some cases to blind enemy observation, but with present instrument equipment in helicopters, smoke may hinder low-level flight if it is used improperly. The basic principle of smoke operations should be kept in mind: It is much more effective when put upon the enemy's position to interfere with his observation than when it is put in front of our own position to conceal our movement.

Secrecy always contributes to surprise. Rehearsals should not "telegraph" the operation. Reconnaissance and photographic activities necessary in preparation for the action should be conducted on wide frontages or in conjunction with activities which do not disclose the planned operation. Communication discipline must be stressed because of the number of people involved in planning the operation, and the amount of radio equipment which is at hand. Panel markings of pickup and rendezvous zones are easily detected from the air and from observation posts. Careful planning and preparation should make them unnecessary.

ACHIEVING SURPRISE

Surprise in timing should be sought by varying the time and method of attack. While darkness and early morning and late evening twilight favor the helicopter-borne forces, surprise is lessened if the attack is repeatedly conducted at those times. Surprise in timing can also be achieved during the shock period after a tactical atomic strike, under cover of jet aircraft noise, or perhaps in conjunction with a chemical attack. Low visibility which restricts or prevents the operation of conventional aircraft favors the helicopter-borne movement. Transitory conditions such as thunderstorms and snow storms will offer concealment, but their exploitation would require a great deal of flexibility in planning and execution.

SPEED COUNTS

The helicopter-borne action should be delivered with SPEED. Speed is the very essence, because the easily attainable cross-country speeds are unique to flying machines. Speed is achieved by preparation and planning. Simplicity in execution should be sought in the interest of speed. Each pilot should be assigned an exact place in the flight formation determined by the location of his point of landing in the objective area. Columnar formations are avoided because they prolong exposure time.

After the operation is under way, the helicopters should not be at rest more than a few moments. The pickup point should be cleared as rapidly as the landing area. After the pickup, the helicopter should go directly to a reorganization area which should be at least five miles away from the pickup point, preferably in the vicinity of the last defilade on the way to the objective area. Each helicopter's position within the flight formation should be the same as its touchdown position in the area. Aerial photographs should be marked to show the exact point where each squad is to debark. Only helicopter-borne ac-

tions can land troops upon the objective in preplanned combat formation. This advantage cannot be overemphasized.

The route is reconnoitered in flight, by map, and by aerial photography. If there is time, a photographic strip mosaic should be prepared and marked, showing the precise route from terrain feature to terrain feature. This strip should show flight hazards and obstacles and safe absolute altitudes required to clear them. The lower the flight altitude in any terrain, the fewer enemy guns can be brought upon the flight. In some corridors of terrain low altitude will protect the flight from fire outside the corridor. This low-altitude feature is especially important because it limits the requirement for supporting fire.

CUT GROUND TIME

The period on the ground within the objective area should be less than one minute. A half minute should provide an easy training goal. Additional heavy lifts after the initial lift should be handled with the same consideration for the principle of speed. These flights are as vulnerable to enemy fire as the initial flights.

If speed to the degree indicated as possible by the foregoing is achieved, there is little chance that enemy fire other than direct fire weapons can be brought onto the objective area during the course of the operation. The troops on the ground gain their protection from retaliatory fires by immediate dispersal to their preselected positions.

The speed of the operation described is far greater than the speed possible with surface vehicles. Combined with the landing of troops in combat formation, this speed makes the helicopter-borne action one of the major tactical advances of the last 50 years.

FIRE SUPPORT

The helicopter-borne force should be SUPPORTED BY FIRE. The helicopter action is a combined arms operation. All methods of support should be used. Artillery should not only plan flak suppressive fires, but known enemy positions should be neutralized by successive concentrations during the progress of the movement. Tactical air support is especially important for dealing with targets of opportunity which appear during the operation. The action, once started, will be so rapid that there will be insufficient time to make corrections in the artillery fire support plan. Tactical aircraft, guided by a controller with the helicopter force, engage targets which were not located and anticipated in the fire plan. Protection from hostile aircraft should also be provided during the short period of the action. This is not "air cover" which must be maintained for hours, but a momentary period of air superiority over the objective area.

The helicopters themselves should have a suppressive fire capability to be used as a deterrent to accurate hostile fire. Machineguns on each helicopter in the formation are used to keep some fire falling in the immediate area through which the helicopters are passing. If the ob-

jective is occupied by the enemy, suppressive fire will minimize losses.

Atomic strikes, chemicals, and long-range rockets are other means of fire support which may be used when appropriate.

These are familiar tactical principles. They involve nothing revolutionary. Some degree of surprise is, or should be, sought in every tactical operation. Fire support is coordinated whenever possible. The planning of an attack to make the final action from a flank or from the rear is tactically sound. The emphasis is new only in the sense that the speeds now attainable are new. When the soldier could move across country at about 1½ miles per hour, there was little point in planning operations at 50 or 100 mph. Surprise, speed, firepower, and "hit them where they ain't" all make good tactical sense. The employment of combined arms is the secret of success here as in other operations.

The problem of meeting these attacks is very interesting, as a separate subject. It seems likely that perhaps a new form of warfare is developing in which greater tactical speeds will be used than ever before.

Airborne attack information along the lines covered in this article can be found in FM 57-35 prepared by the Infantry School in close coordination with the Army Aviation School. This manual is now being printed and will be distributed shortly. The material is presently available in Training Text 57-35-2.—The Editor.

MASTER ARMY AVIATOR

CAPTAIN HARRY W. WILTSE, JR., is the first Army Aviator in the Fourth U. S. Army to be awarded the Master Army Aviator rating. His present assignment is chief of the Flight Operations Branch, Aviation Section, Headquarters, Fourth U. S. Army, Fort Sam Houston, Texas.

He began his Army flying career upon graduation in 1943 from Liaison Pilot Class No. 23 at the U. S. A. Artillery School and as a Liaison Pilot with the 28th Infantry Division. After World War II, he served as flight instructor and flight commander at the Air Training Department, Fort Sill. He was a helicopter pilot with the 4th Helicopter Detachment in Korea. Subsequent tours as an Army Aviator were with Headquarters, Fifth U. S. Army; Headquarters, Seventh Army, USAREUR; and Headquarters, USAREUR, Flight Detachment. Between assignments he completed the Associate Basic Course at the Artillery School, the Instrument Training Course at the Spartan School of Aeronautics, and the Instrument Flight Examiners Course at the U. S. Army Aviation School.

Captain Wiltse is instrument qualified, dual rated, and has logged over 5,575 hours. He has been rated an Army Aviator for more than 15 years and participated in campaigns in World War II and the Korean conflict. He wears nine Oak Leaf Clusters to the Air Medal.

Helicopter Maintenance Trouble Shooting

CWO Lawrence W. Bender, TC

MUCH OF THE TROUBLE encountered in the routine operation of helicopter components, such as the engine, landing gear, radio, and instruments, is similar to that in conventional type aircraft and presents no new problem to pilot or maintenance personnel. There are some aspects of helicopter trouble shooting, however, related to vibrations and control stick forces, whose underlying causes are more difficult to detect and correct. Pilot and maintenance personnel should become familiar with these vibrations and their effect on helicopters.

All flight personnel must realize that unusual vibrations or stick forces are not normal conditions inherent in the helicopter. They should be treated with as much concern as a malfunctioning engine. Certain information to follow can help personnel understand the probable causes of some unusual conditions and guide them in making corrections.

While all helicopters are subject to certain normal vibrations, there are others which can be recognized as abnormal vibrations. (The vibrations and stick forces discussed here are peculiar to the Chickasaw, Choctaw, and Mojave single rotor type helicopters.) Vibrations have been divided into three general groups: (1) low frequency, (2) medium frequency, (3) high frequency. Experienced personnel can distinguish these various frequencies of vibration by clues which become almost second nature to them.

LOW FREQUENCY VIBRATIONS

The *low frequency* vibration, found in the main rotor, is felt as a strong shake or beat at a relatively slow rate. If the fuselage transmits the vibration, the body of the pilot or passenger is noticeably shaken and bounced at a strong, slow rate of approximately three, six, or nine times per second. If the control stick transmits the vibration, the pilot feels a constant repeated kick in the stick at the same frequency. In some cases the vibration will be felt in both the fuselage and the stick. If a vibration reaches the pilot through servo controls it will be of great magnitude. The stronger the vibration force, the more urgent is the need to find the cause.

If vibration is noticed predominantly through cyclic, the probable cause is that the blades are out of track for one or more of the following reasons:

a. Blade damage.

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b. Improper tracking adjustment.

c. Malfunctioning dampers due to: leakage, dirty fluid, loss of fluid, air in system, improper relief valve operation, or binding in attachments, giving a false damper rate.

d. Malfunctioning sleeve or horn assembly.

Vibration noticed predominantly through the fuselage comes down through the main rotor shaft; consequently, the faster the speed of rotation, the greater the vibration. Its causes are:

a. Worn flapping hinge bearings.

b. Faulty drag hinge bearings.

c. Hub improperly installed.

d. Structural defects.

e. Gear box improperly installed.

f. Pylon support legs not torqued.

g. Excessive play in the rotor shaft.

h. Loose hub base nut.

MEDIUM FREQUENCY

The tail rotor drive shafting and the intermediate and tail rotor gear boxes can cause both high and medium frequency vibrations. Medium frequency vibrations are always confined to the tail rotor and will be felt as a localized vibration originating in the tail cone. If in doubt, increase the tail rotor cable tension. In the H-19, the cables will transmit the vibrations to the pedals where they can be recognized by the pilot. To determine vibrations in the H-34 and the H-37, the tail rotor servo would have to be disconnected.

Medium frequency vibration can be traced to the following causes:

a. Rotor out of balance.

b. Rotor improperly rigged.

c. Blade damage.

d. Malfunctioning sleeve bearings.

e. Malfunctioning trunnion bearings.

f. Excessive rod-end play.

g. Worn rod-end bearings.

h. Structural or mounting defects.

HIGH FREQUENCY

The high frequency vibration occurs at engine speed or at higher multiples of engine speed. It cannot be clearly felt, but it is noticed by personnel as a tingling sensation in the soles of the feet, or a tickling sensation in the nose. The instruments are vibrating at such high speed that the indicators cannot be clearly seen and appear fuzzy.

High frequency vibration is found in the transmission, clutch, fan, or engine. An autorotation should be made to localize the source. Some of the causes are:

a. Faulty vibration insulators.

b. Damaged engine mount.

c. Damaged fan blades.

d. Improperly balanced driving disc.

e. Improper assembly of clutch.

f. Damaged spline coupling.

g. Damaged drive shaft.

h. Faulty tail rotor drive shaft bearings.

i. Damage to tail cone.

j. Damage to tail drive shaft support bracket.

k. Loose tail cone.

l. Malfunction of any gear box.

m. Pylon improperly secured.

STICK FORCES

Excessive play or binding in the controls can be corrected by the standard method of disconnecting and isolating the various sections of the linkage until the faulty parts are found. There may be times when the control system operates smoothly on the ground but becomes excessively stiff when flight loads are imposed. Under such circumstances the trouble is generally found in that part of the linkage which includes the servos, and between the servos and the blades.

Lateral stick force, induced by the main rotor, is usually to the left; however, in the H-19, with the servos off, the stick will move to the right. While minor at low speed, it increases with speed.

1. Stiffness is probably caused by:

a. Binding of self-aligning bearings.

b. Control linkage bolted too tightly.

2. Looseness is probably caused by:

a. Azimuth stick loose in the socket.

b. Worn bearings.

c. Ball and socket assembly too loose or worn.

3. Lateral forces can be caused by:

a. Sloppy joints.

b. Servo links tight.

c. Servo piston leak.

4. Sharp fore and aft kick can be caused by:

a. Blade stall.

b. Longitudinal sloppy joints or servo links.

c. Damper out of time, low on fluid or leaking.

These are only general causes of vibrations and stick forces which can be encountered in the helicopter. There are many other unlisted causes which experience alone can help you locate.

A letter from Capt Theo C. Watkins, Maintenance Officer, AFM, Ft Benning, Ga., suggests more information be disseminated concerning our June-July 1958 Puzzler. ". . . in actual operation of the counterweight prop where engine oil pressure stepped up through the governor moves the blades to low pitch (high rpm) and centrifugal force and the counterweights carry the blades to high pitch (low rpm), the propeller will continue to maintain the cockpit rpm setting during failure until all the engine oil supply is exhausted. Corrective action in the event of prop trouble, whether it be a blown seal or otherwise, is to go into full high pitch (low rpm). Probably the first indication of prop trouble on the Beaver will be a heavy film of oil thrown on the windshield or a fluctuating rpm." Thank you, Captain Watkins.—The Editor

Crash Design from Crash Injury Research

Captain William R. Knowles, *MSC*

UNTIL RECENTLY the effectiveness of crash protection was not appreciated because of a common misconception that the human body could not withstand the sudden deceleration normally associated with an aircraft accident. Even though the cockpit might have remained intact and the occupants held in place by safety belts, many persons felt that the abrupt stoppage and associated forces due to impact were causes of fatalities.

Now it has been proved that no aircraft in operation today is as capable of resisting impact forces as is the human body, provided the body is reasonably supported. We know also that the majority of persons killed in aircraft accidents are so injured in one of four ways:

(1) Collapse of the fuselage structure inward upon them.

(2) Their bodies become missiles and are thrown forward against cabin or cockpit structures such as the instrument panel, control wheel, etc.

(3) Although restrained by a safety belt, they are flung violently against some structure near their seat.

(4) An object, such as a fire extinguisher, in the cabin or cockpit breaks free and is thrown violently against them.

Knowledge of the cause of injury or death in aircraft accidents has been extremely useful to modern aircraft designers. Most of them are now working to build aircraft which will provide crash protection to occupants in all except nonsurvivable accidents.

Crash protection features which increase an occupant's chances of surviving are not developments that just came about. For the past 14 years, Aviation Crash Injury Research of Cornell University (AV-CIR) has been conducting a research program directed toward finding the causes of injury and death in survivable aircraft accidents. This research has provided the aircraft industry with facts and figures which they have used in designing more crashworthy aircraft.

BUGABOOS DEBUNKED

Until a few years ago, aircraft were built solely to fly—not to crash. This singular approach to design was costly and is no longer acceptable to many manufacturers in the aircraft industry. Manufacturers previously gave little thought to whether cockpit or cabin design, or the aircraft structure as a whole, was dangerous and capable of producing injuries to the occupants. The cockpit and cabin

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were designed strictly for utility and, in some instances, for comfort. No thought was given to the part design might play in protecting or endangering occupants in a crash. When a crash did occur, injuries were accepted as one of the hazards of flying. If a person was lucky he escaped serious injury; if he was unlucky he was killed. Chance seemed to be the determining factor. However, in analysis of accidents from the standpoint of injury causation, it was observed that a great degree of both safety and danger frequently existed in the same accident.

To determine where crash safety begins and ends, a study of crash injuries in light plane accidents was undertaken. The results of the study indicated that a direct relationship exists between injuries sustained by occupants and the design of the aircraft structures surrounding them.

TYPICAL INJURIES TELL

It was further observed that some injuries were typical of certain types of accidents. Research dispelled the belief that certain other injuries were to be expected. As an example, many thought the snubbing action of a two-inch safety belt caused internal injuries and would cut a person in half under severe impact. This belief was so widespread that some people were actually unfastening their safety belts prior to crashing.

Years of research revealed some startling facts regarding the use of safety belts. Among thousands of survivors of military and civilian accidents, less than 1 percent showed evidence of internal injuries caused by the snubbing action of the belt. Considering the large number of safety belts that have been broken and the violence with which people are thrown in all directions in a crash, this fact served to dispel many doubts about the use of safety belts. It also proved there was very little correlation between the belt and internal injuries sustained in an accident.

Another common misconception concerned shoulder harness. It was thought that a pilot wearing a shoulder harness would probably suffer a broken neck if involved in a fairly severe accident. Many also believed that, with or without harness, the violent impact of an aircraft accident inevitably snapped an occupant's neck, so why wear it?

Again, crash injury research proved this belief false. The study indicated that, except for extreme (disintegrating type) accidents, shoulder harness offers major protection to the chest and head by restraining the body in the seat and preventing it from smashing against a control wheel or instrument panel. Further evidence indicated that the human neck and chest are capable of withstanding forces of extraordinary violence when properly supported.

OTHER INJURIES

Head injuries normally account for about 75 percent of all fatalities in aircraft accidents. Thus, injuries of the head—not the body—are the determining factor as to a fatality or less serious injury in accidents where cabin or cockpit structure is not collapsed and harness is not

This crash told a story to crash injury investigators

utilized. It becomes imperative then that the occupant be restrained by shoulder harness to prevent his head striking against some structure and suffering, in all probability, a serious or fatal injury.

Research also showed that fractures of the extremities, though fairly common in accidents, are usually nonfatal. Painful, yes, and in some cases perhaps the cause of death due to incapacitating the occupant and preventing his escaping a postcrash fire.

Spinal fractures, however, are common to certain types of crashes and certain makes of aircraft. Most of these injuries are compression fractures of the lumbar spine due to the downward impact caused by crashing at high speeds and low angles of attack. In certain aircraft, once the gear has "washed out" the aircraft "bottoms" hard on the belly and the occupant receives this force vertically through the seatpan and associated structure.

Without a seat designed to collapse progressively and absorb the impact energy, the occupant receives a force greater than his spine can tolerate and he suffers a dangerous fracture. New ideas in designing gear, fuselage, and seat structure to prevent such injuries are being incorporated in some of our newer aircraft.

STUDIES EVALUATED

What conclusions can we make from studying crash injuries? One conclusion is that the human body can tolerate very heavy forces, much heavier than the aircraft can withstand. We know that if we restrain occupants in their seats and prevent their heads and bodies from striking any part of the aircraft (by means of safety belts and shoulder harness), they should survive all but extreme (disintegrating type) accidents.

With knowledge of the most frequent injuries, their severity and causation, Aviation Crash Injury Research provides engineers and designers with factual information which they can incorporate into crash protection features for most aircraft. To guard against some compression spinal injuries, landing gear has been designed to collapse progressively to "eat up" the energy of the crash. To protect occupants from being crushed in severe accidents, fuselage structure surrounding the cockpit and cabin is being built to withstand greater impact forces to impede an inward collapse upon the occupant.

IMPROVE DESIGN

Many seats are now delethalized and designed to hold securely in the event of a crash. A strong seat tie-down prevents the seat from tearing free at impact and throwing an occupant into another seatback or forward against cabin or cockpit structure. Seats are also designed to collapse progressively to absorb the force of a crash. The energy-absorbing qualities of the collapsing seat structure aid in dampening the force of impact and prevent the occupants from bottoming hard against the seatpan or floor structure. This, of course, offers further protection to the spine.

Based on data accumulated from hundreds of accidents, engineers are now designing cockpits of some military aircraft to withstand predetermined forces of 40 Gs or more without collapsing. Instrument panels in some aircraft are engineered to "fall outward" at impact or constructed of a delethalized material that will yield and absorb energy, thus preventing head injury if an occupant is pitched forward against it.

The interior design of many aircraft is being modified and cleaned up to do away with projections, knobs, handles, etc., which could cause injury or death if struck by an occupant. In other words, new aircraft design is in the process of incorporating delethalization to the fullest extent possible.

Analysis of data indicated safety belts and shoulder harness should be designed to withstand greater crash forces. This is now being accomplished, and many shoulder harness types have also been modified to include automatic locking devices (inertia reels) to snub the occupant in his seat at the instant of impact. These and many other improvements in crash-survival design are the result of crash-injury research.

Most manufacturers today are safety-minded and wish to market an aircraft which, if involved in an accident, will afford all occupants the maximum protection from injuries.

Future aircraft, designed according to the strength and weakness of the human body, will play a tremendous role in reducing injuries and fatalities in survivable accidents. In time, only those accidents in which the aircraft is disintegrated by crash force will be accepted as nonsurvivable.

WEAR YOUR SHOULDER HARNESS—IT MIGHT SAVE YOUR LIFE.

Helicopters in Survey Operations

Captain Robert F. Litle, Jr., *Inf*

EVERY ARTILLERYMAN KNOWS the importance of survey. Massed artillery fire can be no more accurate than the survey preceding the laying of the pieces. It is also important that this survey be conducted as rapidly as possible; this becomes a more pressing need with modern concepts of warfare.

We must continually seek better and faster means for expediting survey operations. As early as World War II the first attempts were made to utilize the L-4 aircraft as an aid in survey operations. These early endeavors consisted principally of using two or more instruments to track a fixed wing aircraft, which flew toward or away from the instruments to facilitate tracking until the pilot judged that he was over the point to be located. The pilot then transmitted "Mark" by radio, and the instrument operators ceased tracking to read their instruments in the conventional manner. To increase accuracy, a specific portion of the aircraft was used as a sighting point, such as the cross braces of the landing gear. The time lapse between the initial transmission by the pilot and the reaction of the instrument operators made the results hardly satisfactory. Accuracy was little better than that attained from visual map inspection. Although somewhat useful in unmapped or poorly mapped areas and assisting in initial orientation, such a survey was practically worthless in building a survey firing chart.

Captain Robert F. Litle, Jr., is presently assigned to OSACEUR Flight Section, SHAPE Headquarters. Views expressed in this article are the author's and are not necessarily those of the Department of the Army or of the U. S. Army Aviation School.—The Editor

SURVEY AID

The advent of the rotary wing aircraft in Army Aviation opened new considerations to the surveyor. One of the greatest delays in survey operations is the time loss in movement from one instrument station to another, particularly in difficult terrain. If triangulation is being used where the terrain is difficult or impassable or covers long distances in each leg, one or more helicopters can materially reduce the time of movement.

Even though only one helicopter is available, it can assist by carrying men and equipment from one station to the next. A transport helicopter can easily move a survey party of four to six men with their equipment. The following illustration demonstrates the time saved by utilizing the helicopter to assist survey operations:

The target area of a field artillery range at one of the service schools had never been accurately surveyed to the satisfaction of the senior artillery instructor.

One Raven was used to accomplish three-point triangulation and insure the accuracy of the target location. It expeditiously completed a project that three battalion survey parties had been working on for some time.

Two instrument locations were established at known control points, and a third instrument operator was placed in the Raven. All three operators were in radio contact, the operator in the helicopter using a pack-type radio. The Raven landed the instrument operator near each of the targets, many of which were inaccessible by vehicle. The angles read by each instrument operator were reported by radio and added together to check accuracy before moving the target area instrument.

In one afternoon of field work, this exercise permitted the instructors to determine which of some 50 targets had been accurately located by the battalion survey parties. Use of motor transport or movement by foot would have required two or more weeks to complete the task.

POSITION CHECK

Subsequently it became necessary to accurately check the base angles of some 15 battery positions. In this case a different technique employing the helicopter was used.

An aiming circle was placed over the battery center and a second aiming circle was placed on the orienting station of the battery. The Raven hovered over the base point in the target area while the instrument at the battery center tracked it. It was necessary to hover out of ground effect at altitudes of 500 to 2,000 feet to be visible from the battery position. When the pilot judged that he was over the base point he transmitted "Mark" by radio. The battery instrument operator stopped tracking, referred to the instrument at the orienting station, and announced the reading. The instrument operator at the orienting station set the announced reading, laid on the instrument at the battery center, referred to the end of the orienting line, and read the correct base angle.

Repeating the procedure insured the accuracy of the results. A cargo helicopter then moved the two instrument operators to the next battery position where the procedure was repeated.

The survey work was done at a distance of 3,000 - 6,000 yards, and subsequent survey proved that the results were accurate within one mil. Three of the 15 base angles previously used were found to be in error. These corrections enabled the school troop battalions to register faster and obtain more accurate results, making it a more effective firing demonstration.

The procedure described can be used where the target cannot be observed from the survey base with creditable results. It should approach the order of one in 2,000 where the pilot positions the helicopter by judgment.

TIME SAVER

A comparable task was assigned the Engineer Group at Fort Rucker during the fall of 1957. This project was to check the accuracy of all artillery gun positions on the Fort Rucker range. It would have been im-

possible to perform this survey during the time available using conventional methods. Thus, the commander of the Engineer Group decided to utilize the Sioux helicopter to assist in this survey. It was completed in approximately one-sixth the time estimated for a ground survey.

These were operations conducted in peacetime. Naturally, we cannot hover over the target in combat conditions to accomplish our mission, but a great deal can be done behind the lines in such operations as position area survey and connecting survey.

These are only a few illustrations of how the helicopter can assist the surveyor. In addition to field artillery survey, the Army is conducting mapping surveys throughout the world, and helicopters are already assisting in this work. However, the degree of accuracy required for mapping survey is such that the method of utilizing the helicopter as an aiming point will not give satisfactory results, and their primary use to date has been in the transportation role. The essential elements of accuracy in utilizing the helicopter as an aiming point are: that the pilot be exactly over the selected point and that he be able to determine his accurate altitude. The advent of the absolute altimeter (or "hovering indicator") could increase accuracy a great deal if the point on the ground is readily recognizable to the pilot.

Until such instruments are available, some improvement over a pure pilot judgment method may be found by utilizing field expedient "bomb sights" which will allow the pilot or observer to determine his location over the check point more accurately. An example of the type field expedient considered would be an empty 105 shellcase cut off to form a hollow tube with a cross hair sight fastened in the case and mounted in a gimbals to allow it to hang straight down from the side of the cockpit. Such a simple sighting arrangement could be used to fix position more accurately than by pure estimate. It is believed sufficient improvement in accuracy could be obtained by a refined device of this type to permit aircraft to sight points in mapping work. If this be true, thousands of hours of effort expended in jungles, swamps, and other difficult terrain could be avoided.

CORRECTION

In last month's DIGEST, we stated that Post U. S. Army Airfield was named for Wiley Post. Factually, as many readers pointed out, Wiley Post was but 17 years of age when Post U. S. Army Airfield was established by the Signal Corps in 1917 and named in honor of Lt Henry B. Post, 25th Inf, an early Army Aviator who lost his life while attempting to establish an American altitude record in the Wright Model "C." He was the twelfth Army officer to be killed in air crashes.

Pride Kills Local Pilot

Major Jerome B. Feldt, TC

HAVE YOU EVER read a headline like the above? It is doubtful that you have, but that headline would probably tell the whole story on many accidents. Let us take a typical crash story and see what pride has to do with it.

John Farmer crashed near his father's farm late yesterday afternoon. Witnesses stated that the aircraft had flown over the farm several times at a very low altitude. On the last flight, the aircraft started to gain altitude and headed in a northwesterly direction. It seemed to stagger in the air for a moment, then crashed to the ground and burned. Mr. Farmer had recently been issued his flying license at the local airport. He is survived by his father, mother, and one sister.

What did *pride* have to do with this accident? Pride just about tells the whole story. Young John had just learned to fly, and he couldn't wait to show off his new skill to his family. He flew low over their farm home so that his family might see him. In his excitement and exuberance he forgot everything but his pride. He leaned back to wave to his family as long as possible and in so doing pulled the stick back; the aircraft stalled, then crashed. Another pilot killed by pride.

We are prone to say, "Oh yes, that is just buzzing like we all did when we first learned to fly. We no longer do such things though."

Now let us consider the older pilot for a minute. To illustrate, take the case of an Army major who has just received an assignment to command an Army aviation company. He is a Senior Army Aviator, 35 years of age, with 3,500 hours flying time and 15 years of experience. Will the Major try to impress the younger aviators in the company? Is he apt to use his experience as an aviator to accomplish this? They certainly are watching him.

One day the Operations Officer asks the Major when he would like to have his area checkout. The Major replies that he does not have the time right now but he will get around to it in a few days. A week or two goes by and he still has not been checked out.

If the Operations Officer is anxious to make a few points he will probably say something like this: "Major, I have signed off your check ride as I know that you are busy. Besides it would just be a waste of time for you with all of your past flying experience."

The Major answers, "O.K. Thanks very much," rather than insisting that he be checked as other pilots are.

A short time later, when the

Major Jerome B. Feldt wrote PRIDE KILLS LOCAL PILOT while attending the Army Aviation Safety Course at the University of Southern California. He is presently assigned to the 3rd Inf Div USAREUR. Views expressed in this article are the author's and are not necessarily those of the Department of the Army or of the U. S. Army Aviation School.—The Editor

Major is out getting his four hours for the month, he inadvertently flies low over an active rifle range. He crashes a short time later; the aircraft is badly burned, and the Major is killed. The accident is likely to be written up as cause unknown, but it is suspected that the aircraft or pilot may have been hit by a bullet that richocheted from the rifle range. I believe you will agree that pride played an important role in this accident. A proper checkout to identify all of the danger areas may have saved his life.

When we report to the flight line late for a proposed passenger flight and rush through our flight planning, listen to the weather briefing with one ear, and skip the preflight entirely rather than admit that we were late, we are risking our necks and that of our passengers to save our pride.

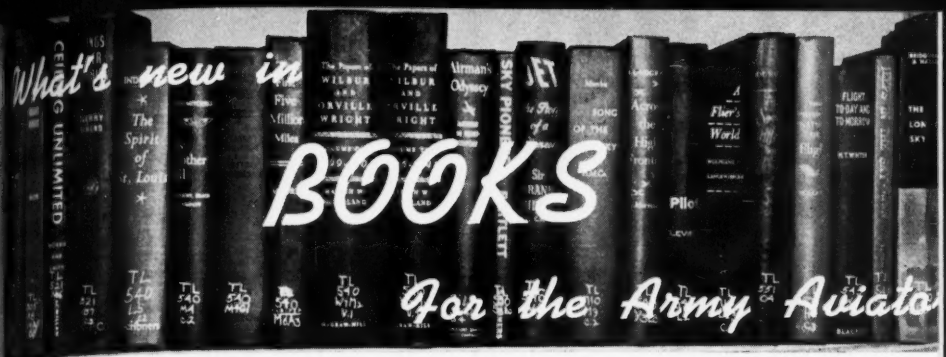
Many times pride has joined forces with foul weather to kill and maim. The pilot encounters weather which is beyond his limitations and the limitations of his equipment to negotiate. Rather than abort the flight and admit to his passengers that he has to make a 180° turn, he enters the weather. You can guess the rest. Even though by some miracle he is successful, the risk involved is not justified if only his pride is lost. There may be other factors that would justify the risk, but it is doubtful that more than pride is involved in most decisions to enter foul weather with which we cannot cope.

I believe that pride enters into all accidents to some degree. How about the unit maintenance officer or unit commander who allows aircraft requiring maintenance to fly so that his availability rate looks good? Or the pilot with a bad cold who does not report to the flight surgeon and ruptures his ear drums on the next flight? Or the pilot who has a good scrap with his wife just before a flight and is so mentally preoccupied that he fails to notice that he has only one tank full of gas and runs out about half way to his destination? They all have allowed their pride to overcome their training, judgment, and plain common horse sense.

Since pride itself is not necessarily a bad characteristic, there must be some ways it can help us. There *are* many.

A mechanic who always proudly maintains a clean aircraft quite likely has a safe one. If he cleans every part of his aircraft, he is sure to have at least looked at every part. We must assume that if he looks at it, he will be able to recognize discrepancies and correct them, or call them to the attention of his supervisors for corrective action. We also know that if an aircraft is clean it will create less drag and be more efficient, allowing greater fuel reserve for a given flight.

Pride can be our greatest ally when used correctly. Pride is a great motivating force and has caused men to make great sacrifices and to perform unbelievable feats. It can be used to advantage or disadvantage in aviation flight safety.



OPERATION GRASSHOPPER: Army Aviation in Korea, 1950-53 — Dario Politella (The Robert R. Longo Co., Wichita, Kan., 1958. $4.95)

Reviewed by
Major Byron H. Brite
United States Army Aviation School

At last the daring exploits of the GRASSHOPPERS in the service of commanders and their troops have been recorded for the benefit of all who have a personal or professional interest in the vital functions of Army Aviation. Whether one is merely curious about the dramatic events in Korea during this period or is a serious student who acknowledges that preparation for the future merits an examination of the past, Dario Politella has provided vivid information and food for thought. Only an Army Aviator could tell this story with adequate appreciation of the operational methods and difficulties associated with the enemy, terrain, weather, and logistic requirements.

In the numerous anecdotes which are the substance of the book, credit is given where it is due—to the personalities who performed valiantly in "doing their duty as they saw it." If it appears that the author has made an effort to reflect the glory accruing to the individuals who carried the load, let him. Who would deny them?

Yet, it would be superficial to regard the author's work as just a collection of the deeds of the many individuals cited. Commanders and staff officers who have not been fully aware of the capabilities and operational problems of Army Aviation have the basis for new insight awaiting them within these pages. The many military personnel who were served and supported by Army aircraft during the Korean conflict or WW II will have renewed appreciation of those events.

Nonmilitary readers will be stirred by the various dramatic actions. The names of such primary landmarks as "Punchbowl" and "Heartbreak Ridge" will recall the suspense and excitement generated by the efforts of our troops in battle there. Frequent reference to the maps is recommended so that the incidents described may be placed geographically. Reading of the truce talks reminds us of the Reds' strategy of waving the white flag while preparing for a renewed offensive.

The *Chronology*, *Glossary*, and *Album* are of value for their convenient listing of the primary events during the period of 25 June 1950 to 31 August 1953, for the colorful vocabulary of the Army Aviator, and for the pictures of aircraft, terrain, and operational conditions.

In the words of General Mark W. Clark, "American servicemen in future decades will owe a great debt to the dauntless pioneers of Army Aviation who learned their skills in World War II and developed them beyond all expectations on the bloody peninsula of Korea." This book, which is authentic though not a history text, portrays the employment of those skills by many of the people who possessed them.

Book reviews appearing in this department do not necessarily reflect the opinions of the Department of the Army or of the U. S. Army Aviation School. —The Editor

Memo from Flight Surgeon

CERTAIN PSYCHOLOGICAL REACTIONS can adversely affect the flying ability of aviators. Chief among these forces are frustrations, which foster problems that seemingly cannot be resolved, and in turn may cause trivial matters to assume exaggerated importance and undermine confidence in one's ability and judgment. However, an intelligent approach to an objective understanding of frustration can alleviate some of these undesirable conditions. By knowing the causes of frustration, we are better equipped to make favorable adjustments.

When complex individuals (aviators) are confronted with complex environment (an average day of flying), personal wishes and goals are often thwarted. Frustration may ensue. From such experiences we tend to accept frustration as being frequent and somewhat unavoidable. The layman may classify the barriers that defy and deny his desires into six general categories, the most common being impersonal conditions.

Impersonal conditions could include: duty on holidays, an inefficient groundcrew, a hammer which crushes your thumb, traffic jams, slow moving highway traffic, stoplights, etc. If outside factors exist with impersonal conditions (such as excessively hot, humid weather) we may become irritable and excited.

Although impersonal conditions are blamed for most frustrations, human beings actually cause more. People may help us to our goals at times but, they too, have personal worries and objectives. When their interests oppose our own, someone may be frustrated.

Frustrating human relationships exist in friendship—even marriage. Friends, like wives, are pleasant to have, but they are, after all, individuals with their own goals. Too often individuals get in our hair or under our skin.

People as lawmakers and lawenforcers comprise a third barrier group. Civilized persons respect community laws; however, no individual is too civilized not to disobey them occasionally. Then, the authority of the lawenforcer frustrates the lawbreaker.

In the military, commanding officers must often deny an individual's inclinations. In fulfilling their duties as commanders, they frustrate subordinates. Conflict with superiors and social authority is more frustrating than conflict with impersonal conditions. For one reason, human beings are harder to comprehend than inanimate objects. We expect people to be sympathetic and to cooperate with our wishes. When they are not, our tendency toward frustration increases because we often do not try to appreciate their objections. When a desired course of action is denied, we often attack the barrier aggressively. In dealing with human barriers we find

that they can, and often do, fight back. People may cause physical hurt and feelings of guilt or shame. The initial frustration of being denied is then further aggravated by the frustration of defeat.

The fourth general barrier group causing frequent frustration is personal inability. Victims of this type of frustration are their own worst enemies. Their goals are defied by the shortcomings of their intelligence or physique—or both.

A pilot who loses an eye will be exceedingly frustrated if he cannot manufacture a substitute for his desire to fly. Such frustration is a graphic example of a goal exceeding physical ability.

Lack of intelligence also produces frustration. Individuals often aspire to positions surpassing their mental ability. Only when they have been exposed to their goals do they realize their ineptitude. They are liable to self-recrimination, bitterness, deep-rooted insecurity, and a sense of inferiority to society.

The fifth and sixth general causes of frustration concern conflicting motives and needs. The person who must choose between two desirable courses of action is an example of the fifth category, conflicting positive motives. Both choices are equally desirable; yet, he must deny one by choosing the other. The choice denied remains in the background and may "haunt" the individual, causing frustration.

The man who chooses a flying career as opposed to an executive position in industry will often return in his mind's eye to the denied course of action, wondering "what might have been." Depending on the circumstance which prompts such reflection, frustration may or may not be forthcoming.

The sixth cause of frustration arises from conflicting positive and negative needs. The frustrations commonly associated with temptation are included here. The victim is characteristically grumpy, tensed, and, in part, physically or mentally lazy. By habit he chooses the easy way or the negative course. He talks of setting the world afire and is contrarily sunk in inactivity because he fears unfair competition, failure, or his own inabilities. For some, these fears frustrate more effectively and permanently than in cases of the preceding groups.

Temptation arises when a choice of action conflicts with a person's code of ethics. The temptation may frustrate. If a person's conscience and needs are equally strong, he may experience severe frustration when choosing between positive and negative needs. Either the desire to be morally correct or the need for illicit gain is denied. If he makes a negative choice and does evil, frustration will be manifest by guilt of conscience and shame. The so-called "guilty conscience" will be proportionate to the individual's character.

Generally, our first reaction to frustration is rational; that is, we attempt to resolve the problem with an intelligent approach. If our initial common sense is replaced by emotion, our reaction

Views expressed in this department are not necessarily those of the Department of the Army or of the U. S. Army Aviation School.—The Editor

then becomes one of aggression, regression, apathy, fixation, repression, or escapism.

"Do not put all your eggs in one basket." Never be without alternate or separate courses of action which will assure some measure of accomplishment.

"Do not burn the bridges behind you." Alternate and separate courses of action may necessitate retreat to a better position for the successful flanking approach.

Analyse the possible opposing actions in order to more effectively time and execute the approach.

In short, make an adequate estimate of the situation and avoid building up excessive hope and desire for something that is improperly timed, improbable or even impossible to accomplish.

PUZZLER

I. GENERAL SITUATION

The 20th Infantry Division has been in I Corps reserve for the past 10 days. The Division Commander has just received orders to relieve the 55th Infantry Division at 060400 June.

II. SPECIAL SITUATION

It is 040900 June. You are the newly assigned 20th Division Aviation Staff Officer. You have just attended a division briefing relative to the forthcoming operation and have received authorization for direct liaison with the 55th Division.

III. REQUIREMENTS

1. What instructions, if any, do you issue at this time?

2. Who should accompany you on a liaison visit to the 55th Division Aviation Company?

3. What primary interest would you as the Division Aviation Staff Officer have during this initial liaison visit?

4. During the visit, to what specific points would you expect the members of your liaison party to give primary consideration?

5. Upon returning to the 20th Division area, you formulate plans to effect the relief of the 55th Division Aviation Company. Must you submit these plans for approval, and if so, to whom?

Study the foregoing questions with care and do not peek at the solution until you have come to a conclusion on each question asked. After arriving at your answers, turn to page 32 for the recommended solution.

When the mind is in a state of uncertainty the smallest impulse directs it to either side. — TERENCE

No one can say with authority what takes place in the mind of a well trained aviator that causes him to react to a set of circumstances in a manner completely alien to his training. However, experience and statistics indicate that physical and mental fatigue, anxiety, and uncertainty play major roles. All of these were present to some degree in the following accident.

Because a specific type of torque wrench was unavailable at the unit, it became necessary to fly the Choctaw to another location for a periodic maintenance check. The pilot spent 5 hours inspecting and checking the Choctaw on the day before the flight, including a 1-hour test flight.

That night the pilot went out to dinner with friends; he returned to his quarters at 2230 hours. The next morning at 0540 hours he was on the flight line ready for the flight. He had a maximum of 6 hours sleep as he had to rise at 0445 hours to dress, eat, travel to the flight line, and make preparations for the cross-country mission.

The pilot declined the offer to carry a copilot on the assigned mission. It was unknown how long the necessary maintenance checks would take at the destination, so permission was given for him to remain overnight.

He took off at 0614 hours, with a mechanic aboard. The outbound flight should have required approximately 3½ hours, but due to navigational error, the pilot arrived at a point 130 miles from his destination. After landing and refueling, he continued to the destination, arriving at 1247 hours. He was in actual flight for not less than 5½ hours on the outbound flight.

An observer stated that although the pilot appeared weary on his arrival, he declined transportation to the nearest eating establishment and remained on the flight line. After maintenance was completed, at 1430 hours, he appeared anxious to depart on the return flight. He was delayed for 1½ hours due to his lack of understanding the

The Gray Hair Department is prepared by the U. S. Army Board for Aviation Accident Research with information from its files. Views expressed in this department are not necessarily those of the Department of the Army or of the U. S. Army Aviation School.—The Editor

Bird Dog Classic—IV

AND WHEN THE KNIGHT had flown far to reach his destination, he spake into a small black box, requesting of those who heard, a suitable path for alighting. And a voice spake into his ear, saying:

"Alight thee to the northwest and heed the wind which bloweth across that path from the port. Its velocity turns the leaf but doth not disturb the limb."

With this knowledge, the knight slowed his charger and dropped flaps to approximate the half of one right angle. He canted the craft to port and crabbed for a straight approach to the assigned path. Before he raised the nose, the knight removed all crab and lowered the port wing in a manner that kept the beast aligned with the path. And when the time came he brought it into a position that caused the left foreleg and tail to meet the turf in the same instant. All was well for this was indeed the manner written and talked of in all the kingdom.

THEN THE KNIGHT FORCED HIS STEED TO DROP ITS RIGHT FORELEG TO THE SOD!

As though to chase its tail, the charger began a turning to port that grew faster and faster. In great awe, the knight kicked right stirrup to the limit and engaged the brake in like manner; alas, it was to no avail. While the steed skidded over the sod its right foreleg folded beneath. The right wing crumpled into the ground while its mate rose higher in the air. And when its nose was pointing to the direction from whence it had come, the craft slid rearwards for five paces and slumped to a halt.

The shaken knight dismounted and looked longingly at the sky. For it were better that he were not found in that place. And he tore his hair and rent the air with curses, calling upon all to witness the weakness of the brake and rudder.

Before the dust had settled,

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necessary procedures to obtain a flight clearance from Flight Service, and by a tieup of communications lines. Another observer stated that the pilot seemed tired and irritable just prior to his departure at 1613 hours.

During the return flight, thunderstorms built up along the route, and heavy rainshowers reduced visibility in the approaching darkness. It seems unlikely that the pilot maintained a listening watch to the various radio stations along his route, because he failed to make a position report at any time, and weather advisories were warning of the severe thunderstorms in the area.

A motorist observed the Choctaw following a highway. He stated that the aircraft entered an area of extremely heavy showers, made a 180° turn and flew back into a lighter area; then it turned again, and flew

the gray beards arrived; and one who was wiser than the rest tossed blades of grass into the air and watched their fall to earth. And when he had seen, he called to the others:

"Seek no more, the answer is plain! Heed not this talk of weak brake and full rudder, for these are blinds that hide the truth."

And when they were gathered about him, he spake in a voice of great wisdom:

"The ways of the bird are known and thy scrolls tell of this knowledge. Listen well, lest thou also forget!

"This knight was observed to have alighted his steed in the correct manner for the wind across this path. But then he forced the bird to lower its right foreleg. In this manner, by moving the controlling stick to the downwind position, the knight slew his correction for the port wind and all directional control was lost to him.

"Thy bird is like unto the weathercock, and when the wind doth blow, its tail will move downwind because of the broadness of its surface and the lightness of its weight. And when the wind is cross, thy upwind wing receives more air because thy downwind wing is blocked from a portion of its air by the upwind wing and the body of the bird. Thus, thy upwind wing doth produce more lift and drag than its mate and this would turn the bird. But this need not be, for thou dost hold in thine hand a full measure of correction. If thou holdest the controlling stick toward the wind, the aileron of thy downwind wing doth move downward and provide the drag that is greatly needed. In this manner, the aileron of thy upwind wing doth move upward to halt the lift and drag that is there. Heed well that as thy ground roll slows, the bird would more like to turn and a greater surface of aileron is s o r e l y needed.

"Fear not for thy downwind leg remaining in the air, for as the bird doth cease to fly it will walk on all legs without thy aid."

And the gray beards called for their cups, for they were very wise and such was the custom in those days.

back into the rainstorm. The motorist further stated that the rain became so severe at this time he was forced to park his car because he could not see to drive.

A short time later the Choctaw crashed in a nose-down attitude. The aircraft began to disintegrate upon initial impact, but continued forward for 7½ feet on the engine compartment and main landing gear. At that point the engine was torn loose from its mounts, and the main rotor blades scraped the ground. The fuselage continued forward, turning and rolling to the right side. The tail section parted on the left side, and the aft section and pylon assembly folded to the right at a 90° angle to the fuselage. The main rotor head and transmission fell to the right, landing in an inverted position and ripping the top of the fuselage along the left side for a distance of 12 feet. The fuel cells

Tragedy of errors

were torn open at impact, and a fire developed that was confined to the immediate area by the heavy rains and water standing in the impact area.

Both the pilot and mechanic were thrown violently against the forward part of the cockpit and received multiple injuries, any one of which could have caused instant death. As the fuselage ripped open, the mechanic was thrown clear, but the pilot was caught in the wreckage.

This pilot exceeded his capabilities in attempting to fly through an area of extremely low visibility and ceiling.

Mental and physical fatigue are believed to have been important factors in this accident. This condition was induced by excessive flying within the 13-hour period prior to the accident, and intensified by the tension and anxiety caused by navigational errors, turbulent weather, lack of proper rest, and the desire to complete the flight.

Any pilot who pushes himself to the limits of physical and mental endurance invites disaster. Army Aviation requires mental alertness and physical agility. These qualities are not present in a tired and irritable pilot. Remember this the next time YOU'RE in a hurry to get home!

COOL HEAD SAVES CHICKASAW

Contrary to popular belief, those charged with the responsibility of publishing accident cause factors do not enjoy placing the blame on aviators. Unfortunately, in a high percentage of accidents, that's the way the ball bounces. When a chance comes along to give an aviator a pat on the back for a job well done, it's a great pleasure to shout it out in our loudest voice. More can be learned from reading the positive account of what an aviator did to avoid damage to his aircraft than a negative account of what he failed to do.

First Lieutenant Wallace G.

Blaisdell, Fort MacArthur, Cal., was on a service flight to ferry three passengers from a Nike site to Fort MacArthur. Aboard the aircraft were a mechanic and the three passengers.

Lieutenant Blaisdell made his takeoff from the Nike site and flew across the San Fernando Valley. Approaching the Santa Monica mountains on a southerly heading, he increased power to clear the mountains that were a mile ahead. As the power was increased, the engine started backfiring and rapidly lost power. The terrain below the aircraft was heavily wooded and hilly. The only possible landing site was a narrow firebreak road in a valley to the right.

Lieutenant Blaisdell went into immediate autorotation and made a 180° turn to the road, selecting the widest portion as a touchdown point. All switches were turned off at approximately 10 feet above the road, and a normal autorotative landing was made. The aircraft rolled forward for a distance of 15-20 feet and the main rotor blades struck a heavy bush. The three rotor blades were damaged near the tips; this was the only damage to the Chickasaw.

Inspection of the engine revealed that the exhaust rocker arm on No. 7 cylinder assembly was missing. The castellated nut was stripped from the valve rocker shaft. The cause of engine malfunction was attributed to overtorquing of the nut to stop an oil leak.

The clear thinking and quick action of this aviator prove that he was prepared to deal with an emergency. This preparation can result only from TRAINING, PRACTICE, THOUGHT, AND HARD WORK.

Well done, Lieutenant Blaisdell!

Cool head saves Chickasaw

Two on the throttle and two in the trees

TREED BIRD DOG

The student pilot completed his high and low reconnaissance, set up the base leg, and made his approach to the strip, which was fairly long but had high trees at the opposite end. He maintained a good angle of descent throughout the approach, passed his go-around point in good condition to complete the landing and continued the approach. Just over the end of the strip, the Bird Dog began to settle rapidly. The instructor waited until the last moment to put in a correction with the throttle, hoping the student would recognize the need. When he could wait no longer, the instructor applied a light throttle correction to stop the fast descent. The student pilot felt the instructor on the throttle and believed him ready to begin a go-around, so he pushed the throttle forward, and the aircraft rose. The instructor pulled back on the throttle but the aircraft continued to rise. As he pulled harder the throttle came to the rear, but the aircraft continued under full power. As the instructor yelled to the student, he saw the trees at the end of the strip coming toward him rapidly. He booted hard on a rudder and steered the nose of the aircraft between two large trees. Then he felt a sudden jolt and heard the crumpling wings tear away from the fuselage. The aircraft dropped to the ground and nosed over. The instructor and student evacuated quickly, staying only long enough to turn off the switches and gas.

Almost every instructor who has spent much time in the rear seat of the Bird Dog has been exposed to this situation. Fortunately, the results aren't usually so drastic. Mostly, this situation results in a few GRAY HAIRS or a badly rumpled seat cushion. But it is a serious condition and one that can and should be corrected.

What happens is very simple. The rod that connects the

throttles of the two control quadrants is long and flexible. When the front throttle is opened, pressure to close the rear throttle causes compression on the rod and it bends outward. This makes it impossible for the instructor to override the student for throttle control. There have been instances where the rod bent outward and upward, jamming itself over the tuning handle of the radio. When this happens, the instructor must lean forward and pull it loose. It can be readily seen what would happen if this occurred at a critical time.

A correction has been determined for this peculiarity of the Bird Dog. All School aircraft of this model have been modified with a bracket mounted midway between the throttle quadrants, and a fix, worldwide, has been sent out from TSMC. On aircraft that have not yet been modified, pilots should be aware of this potential danger and be guided accordingly. During dual instruction flights, it should be understood at all times who has control of the throttle. "I've got it," can save sweat and the taxpayer's dollar.

Recommended Reading

UNARMED INTO BATTLE—Maj Gen H. J. Parham and E. M. G. Belfield (Wykeham Press, 85 High Street, Winchester, England)

Reviewed by
Dario Politella

The British have apparently done a much better job publicizing their L-pilots than we have. This book appeared in 1956, published under the auspices of the Air OP Officers' Association. It was three years in the writing.

General Parham, who as an Artillery captain in 1933 advocated air OPs, and Belfield, a former artilleryman-turned-author, are able writers. Theirs is by far the most complete treatment of the history of air OPs this writer has read. The authors have traced the development of air observation from its earliest inception in 1783 through World War II. The detailed history of the British air OP pioneers and the struggles they encountered in the establishing of an air OP in the British Army makes interesting reading.

The frustrations of our British counterparts are so reminiscent of our own that for this reason alone, the book is worth reading. It will come as no surprise to veteran "Grasshoppers" in this country that interservice misunderstanding existed between the RAF and the British Army. The situation was further complicated by the opposition, as well as lack of understanding and outright indifference, of their own ground officers.

The book reveals that the first experiments with air OP were held in 1938. These were witnessed later by Major General Robert M. Danford, then Chief of U. S. Artillery, who subsequently directed Lieutenant Colonel William W. Ford to investigate a similar program.

All told, the record makes interesting reading. This book should be included in every Army Aviator's library.

Solution to PUZZLER

On the basis of the factual information contained in the PUZZLER on page 24, the recommended solution is as follows:

1. Immediately alert the Aviation Company Commander concerning the forthcoming move. Upon receipt of this order, he will issue necessary orders to the remainder of the company.

2. The liaison party should include the Aviation Company Commander, Communications Officer, Maintenance Officer, and the Operations Officer.

3. Your primary interests would be:

a. The aviation situation in the 55th Division's zone of responsibility.

b. Significant enemy activities, especially those most directly affecting Army Aviation.

c. General disposition of units of the 55th Division.

d. Logistical Aviation problems of the 55th Division.

e. Present employment of elements of the 55th Division Aviation Company.

f. Formulation of a coordinated plan to effect relief at the prescribed time.

g. Possible exchange of some supplies and equipment with the 55th Division Aviation Company (communication facilities, drum-for-drum exchange of POL, etc.)

4. a. The Aviation Company Commander will discuss with the Company Commander of the 55th the details of the physical occupation. Some points to be considered are the phasing in and out of aircraft and the times for final occupation by the various elements of the company.

b. The Communication Officer will be primarily concerned with the continuity of communications, both wire and radio. Arrangements can be made to utilize wire facilities already in place.

c. The Maintenance Officer will be interested in the facilities for maintenance. Some item-for-item exchange can be arranged to avoid double transportation.

d. The Operations Officer will become responsible for continuity of operations during the move. For security, having Aviators and observers of the 20th Division fly with their counterparts of the 55th until the relief is completed will be a function of the Operations Officer.

5. Your plans must be submitted to ACofS, G3, for approval.

There are, of course, many other things to be done. The foregoing were presented as examples of the problems involved. Hope your thought has been stimulated. Like this type of puzzler? Let us know.—The Editor

THE NEW RULE

Effective 15 August the new altitude separation rule went into effect. The rule begins 3,000 feet above ground. At that altitude the rule is based on altitude above sea level. If you take off from a field at 1,000 feet elevation, with your altimeter set to field elevation, you would go to 4,000 before the rule took effect.